DESIGN AND ANAL ,YSIS TECHNIQUES FOR JPL MOBILE ANTENNA DEVELOPMENTS

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One and a half decades ago, the Jet Propulsion Laboratory (JPL), under the sponsorship of NASA, began pioneering the development of land vehicle antennas for commercial mobile satellite communications. Several novel antennas have been developed to meet many stringent system requirements at both the 1.-band and the Ka-band frequencies. These antennas include omni-directional low-gain type as well as satellite tracking medium-gain type. For the medium-gain type, both the mechanically steered arrays and the electronically scanned phased array have been developed. The developments of these antennas involve three principal methods : mathematical analysis, conventional design technique, and empirical iteration. Some antenna developments rely heavily on analyses, while other developments rely more on empirical techniques,

For the L-band Mobile Satellite (MSAT) program, the crossed drooping-dipoles low-gain ant enna was analyzed by the hybrid MM/GTD technique and designed by empirical means. The low-gain higher-order mode circular patch was analyzed and designed by the Multimode Cavity Theory and GTD. Its design was also accomplished partially by empirical method. For the MSAT medium-gain phased array antennas, the analysis and design were carried out mostly by conventional array and circuit techniques. A significant amount of empirical effort was performed to improve the antenna performance. The mechanically steered microstrip Yagi array had its radiators analyzed by the Moment Method and its beamformer designed by conventional circuit techniques. Empirical iterations were carried out to optimize the ant enna performance.

For the 20/30 GHz ACTS Mobile Terminal (AMT) program, a small mechanically steered elliptical reflector antenna was analyzed and designed by the Physical Optics technique. A mechanically steered MMIC active array has also been developed for the AMT program. It consists of distributed MMIC amplifiers with printed subarrays of series-fcd slot and dipole radiators. The designs and analyses of these slot and dipole subarrays were accomplished by a combination of the transmission line theory, the Finite Difference Tim Domain method, the conventional array theory, and empirical optimizations.

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